REMARKS

Claims 1-5 and 7-20 stand rejected either under 35 U.S.C. 102(b) as being anticipated by Weiberle et al. (U.S. Patent No. 6,256,570), under 35 U.S.C. 103(a) as being unpatentable over Tsukamoto (U.S. Patent No. 6,231,133) in view or Weiberle et al., and/or under 35 U.S.C. 103(a) as being unpatentable over Weiberle et al. in view of Takamoto. Applicant respectfully asks the Examiner to reconsider these rejections in view of the below Remarks.

The present invention is directed to a control scheme for a braking system which is particularly adapted to provide system redundancy, while at the same time reducing the likelihood of complete system failure in the case of catastrophic failure (such as caused by an exploding tire, a fire or the like) of one of the system components being controlled. This has been a problem with known prior art systems, which generally operate in one of two ways.

In the first type of known prior art system, multiple controllers are provided, each of which controls some of the brake system components, but not others. Thus, for example, a system may include two controllers, each providing control signals to half of the brake system components. Thus, in the case of failure of one controller, half of the system components would still be controlled.

In the second type of known prior art system, multiple controllers are provided, each of which provides control signals to all system components on a full time basis (i.e., true redundancy). While this may appear desirable in that should one of the controllers fail, all of the system components would be receiving control signals from the other controller, in practice, this type of system suffers from at least one significant drawback. Specifically, in the event of a catastrophic failure in one of the system components controlled by both controllers (such as caused by an exploding tire, a fire or the like), both control networks may be shorted out, thus causing both control networks to fail resulting in a complete loss of control of all system components.

The present invention remedies the deficiencies of both types of prior art systems. In the present invention, first and second control networks electrically connect one or more controllers with first and second brake components, respectively. An auxiliary control link is activatable to electrically connect the first brake component and the second brake component only when a failure occurs in one of the first control network or the second control network, the auxiliary control link being adapted to transmit the control signals between the first brake component and the second brake component only when the failure occurs. Such an arrangement provides redundancy in that should the first controller fail, the first brake component would be provided control signals through the auxiliary control

link from the second brake component. Moreover, the system is not prone to complete failure, in that should the first brake component suffer from a catastrophic failure, the first control network may be shorted out -- the second control network being safe since the first brake component was not directly connected to the second control network when it suffered catastrophic failure. Thus, other brake components which have been controlled by the first control network (now shorted out) may be supplied control signals by the other half of the "pair" to which they belong through auxiliary control links, thereby rendering only a single brake component (i.e., the one which suffered from a catastrophic failure anyway) without control signals.

Claims 1 and 12, the two independent claims, require, among other elements, that each auxiliary control link is <u>activatable to electrically connect</u> the first brake component of each pair of brake components and the second brake component of each pair of brake components <u>only</u> when a failure occurs in one of the first control network or the second control network and that each auxiliary control link be adapted to transmit the control signals between the first brake component of each pair of brake components and the second brake component of each pair of brake components <u>only</u> when the failure occurs.

Applicant respectfully submits that neither Weiberle et al. nor Tsukamoto discloses, teaches or suggests the above-highlighted elements.

Weiberle et al. discloses an electrical braking system for a motor vehicle which includes a pedal unit 10, four wheel units 12, 14, 16 and 18, an energy diagnostic unit 20 and a processing unit 22. Each wheel unit (12, 14, 16, 18) is composed of a wheel module (12a, 14a, 16a, 18a), the wheel sensors (e.g., for example, n1, F1i, s1H, etc.) and an actuator (12b, 14b, 16b, 18b). Each wheel module (12a, 14a, 16a, 18a) includes a microcomputer system, a monitoring component, and the power electronics for driving the actuator. In one embodiment, actuator (12b, 14b, 16b, 18b) of each wheel includes a resetting (return) device (control via i1R, i2R, i3R, i4R) which, in response to faults that would prevent the brakes of a wheel from releasing, isolates the wheel in question (i.e., releases the brake on that wheel). In order to be able to manage these types of faults even when an energy diagnostic unit (20) is malfunctioning, the resetting device is activated by the adjacent wheel unit of the same axle (e.g. for 12b from 18a). Thus, for example, if there was a communications failure in communications network K1 such that wheel module 12a stopped receiving control signals, a signal would be sent from wheel module 18a via communications link i1R to actuator 12b so as to cause actuator 12b to release.

Applicant respectfully submits that this system is completely different than what is claimed. More specifically, there is no disclosure, teaching or suggestion either that (i) each auxiliary control link is activatable only when a failure occurs, or (ii) that each auxiliary control link be adapted to transmit the control signals between the first brake component and the second brake component of each pair of brake components only when the failure occurs. First, the communications link cited by the Examiner as being equivalent to the required "auxiliary control link" (i.e., links i1R and i2R in Figure 1) do not transmit the control signals. Rather, the communications links pointed to by the Examiner are used to transmit a fault signal indicating that a system fault has been detected, thereby "isolating" and releasing the actuator (i.e., making the actuator not respond to control signals, which due to the fault may be erroneous control signals).

More importantly, even if this "fault" signal could be interpreted as a control signal, there is no disclosure, teaching or suggestion that the communications links in question (i.e., links i1R and i2R in Figure 1) are activatable to electrically connect the wheel modules and the respective actuators only when a fault is detected. While it is true that a fault signal is transmitted only when a fault is detected, there is no indication that the links themselves electrically connect the wheel modules and the respective actuators only when a fault is detected. Absent teachings to the contrary, Applicant respectfully submits that the communications

links in question would, like the communications links of all prior art of which Applicant is aware, always electrically connect the two components. This is a critical distinction between the present invention and Weiberle et al. In Weiberle et al., because communications links always electrically connect the wheel modules and the respective actuators (even if no signal is always being transmitted thereover), the system, like all prior art systems of its type, is prone to complete system failure. For example, if a catastrophic failure (such as caused by an exploding tire, a fire or the like) were to occur at wheel 18, wheel module 18a could be severely damaged. Damage to wheel module 18a may cause the entire communications network K2 to be shorted out and fail. Moreover, because link i1R between wheel module 18a and actuator 12b always provides an electrical connection therebetween (even if no fault signal is always transmitted thereover), damage to wheel module 18a may cause portions of actuator 12b, and thereby wheel module 12a (via link i1H and/or i1K), and even potentially entire communications network K1, to be shorted out and fail. With the present invention, such would not be possible, since the auxiliary control links are activatable to provide an electrical connection only when a fault has occurred.

Tsukamoto discloses a vehicle brake controller which detects faults within the system and then applies a modified control algorithm if such a fault is detected. However, there is no disclosure, teaching or suggestion either that (i) each

auxiliary control link is activatable only when a failure occurs, or (ii) that each auxiliary control link be adapted to transmit the control signals between the first brake component and the second brake component of each pair of brake components only when the failure occurs. First, the communications link cited by the Examiner as being equivalent to the required "auxiliary control link" (i.e., the link between brake pressure controllers 10F and 10R in Figure 19) does not transmit the control signals. Rather, the communications link pointed to by the Examiner is used to transmit a "no fault" signal indicating that no system fault has been detected. Moreover, even if this "no fault" signal could be interpreted as a control signal, the communications link in question is not activatable only when a fault is detected. In fact, in order for the Tsukamoto system to operate as disclosed the communications link in question must operate in just the opposite fashion. More specifically, Tsukamoto discloses that each brake pressure controller 10F, 10R expects to receive a "no fault" signal from the other brake pressure controller 10F, 10R at all times unless a fault is detected. See Column 18, lines 46-54:

> When the brake pressure controller 10F (10R) has a fault, or when energization from the battery 11F (11R) is interrupted, the process itself can no longer be executed and a fault information signal cannot be input to the other controller 10R (10F).
>
> Therefore by determining that a fault has occurred unless a signal to the contrary is input in the step S402, a fault can be detected in the other controller, not only in the actuator but also in the controller or battery.

(emphasis added). It would make no sense to activate the communications link only when a fault existed (as required by the claims) only to then not provide a "no fault" signal to indicate that a fault has occurred.

Since neither of the cited prior art references discloses, teaches or suggests in any way an auxiliary control link which is activatable to provide an electrical connection only when a fault is detected, Applicant respectfully submits that a combination of the two could not result in a system which includes such a link.

For the foregoing reasons, Applicant respectfully submits that all pending claims, namely Claims 1-21, are patentable over the references of record, and earnestly solicits allowance of the same.

Respectfully submitted,

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Amendments to the Drawings:

No amendments to the Drawings are made herein.